United States
Environmental Protection
Agency

EPA530-R-07-001
April 2007

National Priority Chemicals Trends Report (2000-2004)

Section 4
Chemical Specific Trends Analyses for Priority Chemicals (2000−2004): Phenanthrene

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Phenanthrene

Chemical Information:

CAS Number − 85−01−8

Alternate Names − PhenAnthracene

General Uses − Phenanthrene is used to make dyes, plastics, pesticides, explosives and drugs. It has also been used to make bile acids, cholesterol and steroids.

Potential Hazards − Phenanthrene may cause irritation to the skin and respiratory tract. It emits acrid smoke and fumes when heated to decomposition.

Summary Analysis:

- NATIONAL: In 2004, 55 facilities reported approximately 2.3 million pounds of phenanthrene. Compared to the quantity reported in 2000, there was a significant increase of approximately 1.3 million pounds or approximately 131 percent in 2004.
- REGIONAL: In 2004, facilities in EPA Regions 4 and 6 reported 90 percent of the phenanthrene.
- STATES: For 2000−2004, facilities in 25 states reported phenanthrene. In 2004, facilities in five states reported 96 percent of the total quantity of phenanthrene in 2004. Facilities in Texas and Kentucky reported 70 percent of the total quantity.
- MANAGEMENT: Facilities used both energy recovery and treatment to manage phenanthrene; there was no apparent trend regarding the extent to which these methods were used from one year to the next. In 2004, approximately 52 percent of the total quantity of phenanthrene was sent to energy recovery, approximately 44 percent was treated, and 4 percent was land disposed.
- FACILITIES: Of the 55 facilities that reported phenanthrene in 2004, five facilities reported approximately 94 percent of the total quantity of this chemical.
- INDUSTRY SECTOR: Facilities in five industry sectors reported more than 99 percent of the phenanthrene in 2004.

National Trends:

Exhibit 4.238 shows the number of facilities that reported phenanthrene in 2000 to 2004 and the quantities that were managed via disposal, treatment, energy recovery, and recycling. In 2004, 55 facilities reported approximately 2.3 million pounds of phenanthrene. Compared to the quantity reported in 2000, there was a significant increase of approximately 1.3 million pounds or approximately 131 percent in 2004. Compared to the quantity reported in 2003, the quantity also increased significantly, by approximately 531,000 pounds or approximately 29 percent. In 2004, 10 more facilities reported phenanthrene than did in 2000.

For 2000−2004, facilities used both energy recovery and treatment to manage phenanthrene; there was no apparent trend regarding the extent to which these methods were used from one year to the next. In 2004, approximately 52 percent of the total quantity of phenanthrene was sent to energy recovery, approximately 44 percent was treated, and 4 percent was land disposed. Since 2000, recycling of phenanthrene increased by approximately 89 percent; 833,000 pounds of phenanthrene were recycled in 2004.

Exhibit 4.238. National Management Method Trends for Phenanthrene, 2000−2004

Management Methods for Phenanthrene and Number of Facilities	2000	2001	2002	2003	2004	Percent Change (2000−2004)	Management Method − Percent of Quantity of This PC (2004)
Number of Facilities	45	51	50	54	55	22.2%	-
Disposal Quantity (pounds)	20,094	74,673	42,529	73,264	86,541	330.7%	3.7%
Energy Recovery Quantity (pounds)	178,622	98,317	2,196,260	749,069	1,226,086	586.4%	52.2%
Treatment Quantity (pounds)	818,822	63,250	70,549	995,472	1,035,638	26.5%	44.1%
Priority Chemical Quantity (pounds)	1,017,538	236,240	2,309,338	1,817,805	2,348,265	130.8%	-
Recycling Quantity (pounds)*	441,402	477,928	1,000,783	769,120	833,087	88.7%	-

*Note: Waste minimization is the emphasis of this Report. As such, we primarily focus on quantities of PCs that are managed via onsite/offsite disposal, treatment, or energy recovery because we believe these PC quantities offer the greatest opportunities for waste minimization. Because recycled quantities of PCs are already directed to their best uses, they are considered separate and distinct from the quantities of PCs not recycled. Throughout this section, the recycled quantity is presented to provide some perspective regarding the quantity of this PC already recycled compared to the quantities that are managed via disposal, treatment, and energy recovery and thus potentially available for waste minimization.

Exhibit 4.239 shows the number of facilities that reported phenanthrene within various quantity ranges. Of the 55 facilities that reported phenanthrene in 2004, five facilities reported approximately 94 percent of the total quantity of this chemical. Two of these facilities accounted for approximately 68 percent of the total quantity.

Exhibit 4.239. Distribution of Quantities by Facilities Reporting for Phenanthrene, 2004

Phenanthrene (2,348,265 pounds)		
Quantity Reported	Number of Facilities Reporting This Quantity (2004)	Percent of Total Quantity of This PC (2004)
up to 10 pounds	4	less than 0.1%
11 − 100 pounds	10	less than 0.1%
101 − 1,000 pounds	20	0.4%
1,001 − 10,000 pounds	12	2.0%
10,001 − 100,000 pounds	4	3.5%
100,001 − 1 million pounds	5	94.1%
> 1 million pounds	0	0.0%

EPA Regional Trends:

Exhibit 4.240 shows the quantity of phenanthrene reported by facilities in eight EPA regions in 2000 to 2004. In 2004, facilities in EPA Regions 4 and 6 reported 90 percent of the phenanthrene. Facilities in these two EPA regions accounted for most of the national increase of phenanthrene, compared to quantities reported in both 2000 and in 2003. Two facilities accounted for most of the increase in Region 4; one facility in Kentucky attributed its increase to an increase in the production of carbon rods, the shutdown of another facility, located in Alabama, generated increased quantities wastes from the cleanout of tanks and process equipment.

One facility accounted for most of the increase in Region 6. This facility had not previously reported phenanthrene; it attributed the increase to its use of fuel oil (containing phenanthrene) purchased from a waste broker.

Exhibit 4.240. Regional Quantity Trends of Phenanthrene, 2000−2004

EPA Region	2000 (pounds)	2001 (pounds)	2002 (pounds)	2003 (pounds)	2004 (pounds)	Percent Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
3	9,793	31,682	25,603	64,569	45,657	366.2%	1.9%
4	6,140	1,850	3,982	745,198	924,232	14952.6%	39.4%
5	188,791	77,479	373,060	228,969	190,644	1.0%	8.1%
6	798,299	119,911	1,900,205	768,548	1,177,789	47.5%	50.2%
7	3,140	1,610	1,380	793	1,232	−60.8%	0.1%
8	9,186	1,302	2,772	3,269	2,439	−73.4%	0.1%
9	47	1,133	1,244	5,213	5,157	10872.3%	0.2%
10	2,142	1,273	1,091	1,246	1,115	−47.9%	0.0%
Total	**1,017,538**	**236,240**	**2,309,338**	**1,817,805**	**2,348,265**	**130.8%**	**100.0%**

Exhibit 4.241 shows how facilities managed phenanthrene, by EPA region, in 2004. Facilities in six of these eight EPA regions used energy recovery and/or treatment for most of the phenanthrene. Approximately 86,500 pounds of phenanthrene were land disposed in 2004; facilities in several EPA regions used disposal as the primary method to manage phenanthrene. In 2004, approximately 833,000 pounds of phenanthrene were recycled by these facilities; Region 6 facilities reported approximately 72 percent of this quantity.

State Trends:

In 2000−2004, facilities in 25 states reported phenanthrene. Exhibit 4.242 shows the quantity of phenanthrene that was reported between 2000 and 2004 in the five states where facilities accounted for 96 percent of the total quantity of phenanthrene in 2004. Facilities in Texas and Kentucky reported 70 percent of the total quantity.

Compared to the quantities reported in 2000, facilities in all five of these states reported a significant increase in 2004. Except for Indiana, facilities in the other four states also reported significant increases compared to the 2003 quantities.

The large increase in Kentucky resulted primarily from a facility that increased its production of carbon rods. One facility accounted for most of the increase in Louisiana; this facility had not previously reported phenanthrene and attributed the increase to its use of fuel oil (containing phenanthrene) purchased from a waste broker. The increased quantity in Alabama was primarily due to the shutdown of a facility which generated increased quantities wastes from the cleanout of tanks and process equipment.

Exhibit 4.241. Regional Management Methods for Phenanthrene, 2004

EPA Region	Quantity (pounds) of Phenanthrene (2004)	Percent of Total Quantity of Phenanthrene (2004)	Disposal (pounds)		Energy Recovery (pounds)		Treatment (pounds)		Recycling (pounds)	
			Onsite Disposal	Offsite Disposal	Onsite Energy Recovery	Offsite Energy Recovery	Onsite Treatment	Offsite Treatment	Onsite Recycling	Offsite Recycling
3	45,657	1.9%	0	31,851	0	49	4,041	9,716	25,804	33,000
4	924,232	39.4%	0	27,450	0	97,050	799,482	250	16,531	64,095
5	190,644	8.1%	0	14,016	0	800	173,402	2,426	83,890	0
6	1,177,789	50.2%	216	10,807	1,116,846	11,169	8,060	30,691	0	602,568
7	1,232	0.1%	0	1,232	0	0	0	0	0	0
8	2,439	0.1%	762	20	0	110	1,530	17	914	0
9	5,157	0.2%	0	187	0	0	4,890	80	0	655
10	1,115	0.0%	0	0	60	2	1031	22	5,630	0
Total	**2,348,265**	**100.0%**	**978**	**85,563**	**1,116,906**	**109,180**	**992,436**	**43,202**	**132,769**	**700,318**

Exhibit 4.242. State Quantity Trends for Phenanthrene (Facilities Reporting 96 Percent of the Total Quantity), 2004

State	Total Quantity (pounds) of Phenanthrene					Change in Quantity (2000−2004)	Percent Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
	2000	2001	2002	2003	2004			
TX	792,923	99,828	1,884,994	757,623	845,663	52,740	6.7%	36.0%
KY	0	0	1,500	740,470	804,786	804,786	NA	34.3%
LA	4,478	19,355	10,689	5,234	325,024	320,546	7158.2%	13.8%
IN	17,274	5,423	90	200,452	170,452	153,178	886.8%	7.3%
AL	5,895	1,235	1,917	3,901	118,803	112,908	1915.3%	5.1%
Total	**820,570**	**125,841**	**1,899,191**	**1,707,680**	**2,264,728**	**1,444,158**	**176.0%**	**96.4%**

Exhibit 4.243 shows how facilities in these five states managed phenanthrene in 2004. Facilities in these states used onsite energy recovery and/or onsite treatment for approximately 92 percent of the phenanthrene. Less than 2 percent of the total quantity of phenanthrene was land disposed (mostly offsite); a facility in Alabama undergoing shutdown reported approximately 60 percent of the phenanthrene sent to offsite disposal. Facilities in three of these states reported recycling approximately 749,000 pounds of phenanthrene in 2004; a facility in Texas reported approximately 80 percent of the total recycled quantity.

Exhibit 4.243. Management Methods for Phenanthrene, Facilities in States With 94 Percent of the Total Quantity, 2004

State	Total Quantity of Phenanthrene (2004)	Onsite Disposal (pounds)	Offsite Disposal (pounds)	Onsite Energy Recovery (pounds)	Offsite Energy Recovery (pounds)	Onsite Treatment (pounds)	Offsite Treatment (pounds)	Onsite Recycling (pounds)	Offsite Recycling (pounds)
TX	845,663	196	7,974	796,846	9,713	1,040	29,894	0	602,568
KY	804,786	0	4,804	0	250	799,482	250	0	0
LA	325,024	0	1,790	320,000	0	2,600	634	0	0
IN	170,452	0	6	0	0	170,016	430	81,984	0
AL	118,803	0	22,003	0	96,800	0	0	0	64,095
Total	**2,264,728**	**196**	**36,577**	**1,116,846**	**106,763**	**973,138**	**31,208**	**81,984**	**666,663**

Industry Sector (SIC) Trends:

For 2000−2004, facilities in 17 industry sectors reported phenanthrene. Exhibit 4.244 shows the quantities of phenanthrene reported by the five industry sectors in which facilities accounted for more than 99 percent of the total quantity of this chemical in 2004. In 2004, facilities in SIC 3334 (Primary aluminum) reported 34 percent of the total quantity of phenanthrene. One facility, located in Kentucky, reported most of this quantity. In SIC 2819 (Industrial inorganic chemicals, nec), one facility, located in Texas, reported 100 percent of the total quantity of phenanthrene.

Compared to quantities reported in 2000, facilities in three of these five industry sectors reported large increases in 2004. One facility in SIC 3334 (Primary aluminum) primarily accounted for the increase in this industry sector. This facility, which began reporting phenanthrene in 2003, uses coal tar pitch and coke to produce carbon rods for aluminum smelting. The coal tar pitch contains phenanthrene; increased production of carbon rods results in an increased quantity of phenanthrene. The increase for SIC 2819 (Industrial inorganic chemicals, nec) was caused when the only facility now reporting phenanthrene n this industry sector changed to this SIC code from its previous SIC code 2812 (Alkalies and chlorine) in 2003. Conversely, facilities in SIC 2869 (Industrial organic chemicals, nec) reported a decrease of approximately 383,000 pounds; several facilities in this industry sector reported smaller quantities of phenanthrene beginning in 2001.

Compared to quantities reported in 2003, facilities in four of these five industry sectors reported an increased quantity in 2004. These included increases of 330,000 pounds by facilities in SIC 2869 and 111,000 pounds by facilities in SIC 2865 (Cyclic crudes and intermediates). Most of the increased quantity for SIC 2869 was reported by a facility in Louisiana that had not previously reported phenanthrene and attributed the increase to its use of fuel oil (containing phenanthrene) purchased from a waste broker. The increased quantity for SIC 2865 was primarily due to the shutdown of a facility at which increased quantities of wastes containing phenanthrene were generated from the cleanout of tanks and process equipment.

Exhibit 4.244. Industry Sectors Containing Phenanthrene (Facilities Reporting 99 Percent of the Total Quantity), 2004

Primary SIC	SIC Description	Number of Facilities That Reported Phenanthrene (2004)	2000 (pounds)	2001 (pounds)	2002 (pounds)	2003 (pounds)	2004 (pounds)	Change in Quantity (2000−2004)	Percent of Total Quantity of This PC (2004)
3334	Primary aluminum	2	2,142	250	1,179	741,470	804,914	802,772	34.3%
2819	Industrial inorganic chemicals, nec	1	48,330	18,968	0	728,646	797,429	749,099	34.0%
2869	Industrial organic chemicals, nec	8	747,185	83,624	66,903	33,886	364,031	−383,154	15.5%
2911	Petroleum refining	21	28,725	8,701	16,516	221,246	195,337	166,612	8.3%
2865	Cyclic crudes and intermediates	5	181,781	97,255	387,495	51,255	161,904	−19,877	6.9%
Total		**37**	**1,008,163**	**208,798**	**472,094**	**1,776,503**	**2,323,615**	**1,315,452**	**99.0%**

Exhibit 4.245 shows how facilities in these five industry sectors managed phenanthrene in 2004. Except for facilities in SIC 2865 (Cyclic crudes and intermediates), facilities in the other four industry sectors primarily used onsite treatment and/or onsite energy recovery to manage phenanthrene. Facilities in SIC 2865 used offsite energy recovery to manage approximately 60 percent of the phenanthrene; 34 percent of the phenanthrene was sent to offsite disposal. A facility in Alabama undergoing shutdown reported most of the phenanthrene sent to offsite disposal. Some recycling of phenanthrene was reported by facilities in five of the six industry sectors. In 2004, facilities in these industry sectors reported recycling of approximately 676,000 pounds of phenanthrene; one facility in Texas accounted for 89 percent of the total recycling quantity reported by facilities in these industry sectors.

Exhibit 4.245. Industry Sector Management Methods for Phenanthrene (Facilities Reporting 99 Percent of the Total Quantity), 2004

Primary SIC	SIC Description	Total Quantity of Phenanthrene (2004	Percent of Total Quantity (2004)	Disposal (pounds)		Energy Recovery (pounds)		Treatment (pounds)		Recycling (pounds)	
				Onsite Disposal	Offsite Disposal	Onsite Energy Recovery	Offsite Energy Recovery	Onsite Treatment	Offsite Treatment	Onsite Recycling	Offsite Recycling
3334	Primary aluminum	804,914	34.3%	628	4,804	0	0	799,482	0	624	0
2819	Industrial inorganic chemicals, nec	797,429	34.0%	72	0	796,846	0	511	0	0	0
2869	Industrial organic chemicals, nec	364,031	15.5%	53	2,960	320,000	9,713	3,104	28,201	0	602,115
2911	Petroleum refining	195,337	8.3%	225	8,413	60	1,867	181,913	2,859	6,464	1,108
2865	Cyclic crudes and intermediates	161,904	6.9%	0	55,156	0	96,800	7,191	2,757	1,568	64,095
Total		**2,323,615**	**99.0%**	**978**	**71,333**	**1,116,906**	**108,380**	**992,201**	**33,817**	**8,656**	**667,318**